# Aerospace, Defence and Climate Change: The Risk Dimension

***One of the biggest challenges of tackling issues related to climate change is the global nature of the problem. Many different public and private agencies have a role to play in managing and mitigating the problem. However, the many different interests, motivations and methodologies can create confusion and delay in implementing the best solutions. John Scott and Adam Piper* describe how the insurance and A & D sectors can work together to fight climate change.***

The aerospace and defence industry has been active in developing new technologies that either have a role in reducing emitted carbon dioxide (CO2e) or improving resilience and adaptation to climate change. Similarly, the insurance industry has been active in addressing the challenges of climate change, working with customers from various industries, including aerospace and defence, to create risk transfer products and provide risk management advice. Working together could be a catalyst for both industries to play a significant role in reducing CO2e and the potential impacts of ongoing climate change.

This article discusses some of those approaches for joint working, using a threefold classification: (1) Encouraging the development of new technologies that reduce greenhouse gas emissions, (2) Developing adaptations to the consequences of climate change and (3) Influencing public policy that encourages behaviour change.

## New Technologies

The aerospace and defence industry has been a powerhouse of technology R&D in the search for ever more powerful and power-efficient systems for military use. Harnessing this activity to meet the challenges of climate change could bring significant advances to reducing CO2e. The products available from the insurance industry have been designed to protect private assets, whereas the climate is a public good. Despite this limitation, there are many examples where insurance has been used to encourage the use of new carbon reducing technologies and the adoption of adaptive behaviours. This is especially so in the areas of power generation and transportation, but also in energy efficiency and building resilience. Examples include insurance covers for solar and wind power generation, as well as liability cover for carbon capture and sequestration (CCS) and insurance covers for 'green' and weather resilient construction.

The majority of anthropogenic CO2e comes from burning fossil fuels for power generation - roughly 50% (gas, coal and oil) - and from land transportation (car, truck, bus) or sea transport (ship), around 20%. A relatively small amount of anthropogenic CO2e comes from air transport. Technologies that significantly reduce greenhouse gas (GHG) emissions from these activities are imperative if Intergovernmental Panel on Climate Change (IPCC) GHG reduction targets are to be met.

In power generation, a move to a mix of nuclear, renewable and CCS coal- or gas-fired power stations would help meet GHG reduction commitments and improve fuel security (i.e. make western economies less reliant on Middle Eastern and Russian oil and gas). The defence industry has experience of working with nuclear power for military use and has developed a range of technologies to improve the efficiency and viability of renewable energy sources (hydro, solar, wind, wave, tidal). It has even developed technologies that can improve the low carbon fossil fuel efficiency of power generation (especially coal and gas).

Examples of this type of R&D include stealth technology to reduce the radar impact of wind turbines, thereby allowing them to be used near air traffic control radars (QinetiQ and Lockheed Martin). Similarly, research on the sonar impact of wind turbines on marine wildlife has led to changes in turbine construction offshore.

In the CCS arena, improvements in CO2 compression using supersonic combustion ramjet engine technology have significantly reduced the costs and power requirements of compression, one of many key areas of risk in the successful commercial implementation of CCS. This is also an area where the insurance industry has begun to address the operating liability risks of CO2 injection as well as the cost uncertainties associated with long term storage and sequestration. In particular, the insurance industry has been informing policymakers on the best approaches to managing long-term storage and sequestration risks based on the lessons and experiences of running different types of funding and risk

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transfer mechanisms – for example, in the flood defence, oil pollution and nuclear arenas.

In solar panels, there has been considerable research interest in improving the performance of these for military and civilian use. One example is barrier film technology which improves protection of photovoltaic cells and can improve performance over their lifetime. Lifecycle operating and risk issues are also areas that have been addressed by the insurance industry which has been active in developing insurance covering the cost uncertainties associated with recovery, buyback and disposal of solar panels, so that manufacturers can comply with the requirements of the EU Waste from Electronic and Electrical Equipment (WEEE) Directive. Linked to this is the risk of distributed power systems failing and not providing power, or the potential loss of income from that power to the owner-operators. There is increasing appetite to develop new and emerging insurance products that cover off-grid power business interruption caused by equipment failure or property damage.

The other big new technology opportunity to reduce CO2e lies in the development of alternative engines and fuels for cars. The aerospace and defence industry has multiple opportunities and incentives to develop technologies in this area. If nothing else, military planners now have different asset requirements for forces fighting regional conflicts and anti-terrorist actions than they did in the past. In contrast to Cold War requirements for heavily armoured vehicles, the emphasis is now on more highly mobile forces, using fuel-efficient 'platforms'. Fuel efficiency and reduced GHG emissions go hand-in-hand with high-efficiency. Diesel engines, hybrid electric/petrol or plug-in hybrid or electric-powered vehicles are becoming increasingly common. To help manage the risks of these new fuels and engine technologies, the insurance industry has been developing products and services that either reward use of new technology, for example insurance premium discounts for hybrid vehicles, or encourage driving smarter – either by driving fewer miles or using less fuel such as pay-as-you-drive auto insurance or telematics-enhanced systems that improve safety and efficiency.

The main technological barriers for electric or hybrid vehicles are around battery technology. Significant efforts have been made in defence research establishments to develop, smaller, lighter, more powerful and longer-lasting batteries. Nanotechnology has been used to achieve battery performance improvements. Good risk management practices, a core insurance industry activity, should be implemented with nanotechnology deployment to mitigate potential future liabilities. Examples of some mitigative techniques available from the industry to apply to deployment of nanotechnology include:

- Adoption of a 'life cycle management approach' to nano-materials
- Manufacturing within the confines of the 'precautionary principle', i.e. for the manufacturer to establish reasonable proof that the use of nano-materials in products will not cause significant harm.
- Implementing a 'post marketing surveillance' regime that includes an 'adverse event' reporting system
- Consideration of an 'employee baseline testing protocol', i.e. to ensure that employees are regularly tested and monitored to assess exposure impacts, if any
- Institution of aggressive worker protection techniques to minimize inhalation, ingestion and dermatological exposure to hazardous substances

Alternative fuels such as biofuels and hydrogen are also areas of research by the aerospace and defence industry. Hydrogen requires a more fundamental range of new technologies for it to be widely adopted as a fuel, including cost-effective hydrogen fuel cells, a safe distribution network of hydrogen filling stations and a low carbon source of hydrogen production. Hydrogen production could be closely linked to CCS projects, where CO2 stored in nearly depleted oil and gas reservoirs could displace hydrocarbons which could be transformed (e.g. steam-methane reforming) into hydrogen for use in power generation or as an alternative fuel for vehicles. The insurance industry has been looking at the entire hydrogen supply chain and the insurable risk implications of running hydrogen-powered vehicles.

## Adaptation

On the adaptation to climate change issue, a lot of effort has gone into modelling the potential consequences of changing climate, for example flooding from changing sea levels, or fluvial and pluvial flooding and damage from increasingly intense and frequent storms. The insurance industry is motivated to understand the changing nature of these risks with respect to exposure to existing insurance products. Insurers are evaluating and offering coverage to make existing building stock more weather-event resilient in some cases, but without mandatory building code changes, so the impacts of this voluntary insurance industry effort may be minimal. There are also potential liability consequences of climate change and some insurers are now offering liability cover for climate change related risk for directors and officers, political risk, professional liability, and environmental liability. In developing economies where insurance is not so well developed, micro-insurance schemes have been implemented to respond to food and water shortages in rural areas of South America, Africa, and Asia.

Adaptation has been an important area of focus for the insurance industry and has military applications too. As the effects of climate change are likely to be felt over a number of decades, practical actions will need to be taken to reduce their impact. The insurance industry has a commercial imperative to encourage mitigation of these impacts and better risk selection to reduce losses. The aerospace and defence industry has the know-how and technology to support predictive modelling, for example satellite remote sensing data being used for meteorological forecasting, or models of potential flooding, or power outages in areas affected by severe storms. These models can and have been used to support emergency civilian and military forces who need to respond to natural catastrophes such as flooding or the effects of serious windstorms.

Increased flood risk, related either to changing patterns of fluvial/pluvial flooding or increased intensity and frequency of storms and continuing sea level rise, all contribute to increased losses suffered by insurers. Well publicised examples of major city flooding such as in New Orleans during Hurricane Katrina in 2005 are likely to be repeated, unless significant adaptation occurs - either by building away from flood-prone areas or by building flood defences. The risk-based pricing signal of insurance premiums, or indeed, in some cases, the lack of insurers willing to provide cover, can help encourage developers to build away from flood-prone areas, or to design flood-resilient buildings.

Of course it isn't just flooding that is an increasing risk related to climate change, but the damaging affects of windstorms, drought-stricken areas and wildfires (for example in Southern California and Victoria, Australia). All of the impacts of these events are felt by insurers in increased losses and these require changes to risk models and pricing for insurers to still be able to offer insurance cover that is commercially viable. These risk models can be informed by data from earth observation technology provided by the aerospace and defence industry. Traditional insurance products need to be modified to cope with the effects of climate change, but in addition, new products are being developed. For example, there are new risks associated with systems designed for water re-use and increased storm water run-off which can require innovative insurance solutions to address them.

Another important angle on adaptation is improving the resilience and insulation qualities of buildings. In many countries there are 'green' building codes. Insurers are beginning to offer products that fund rebuilding of damaged properties to these codes and even higher resilience against windstorm damage (stronger roof attachment, armoured glass) and flooding. Technology from the aerospace and defence industry can help in this regard, especially research into green building design and high-tech glazing. For the main customer of the aerospace and defence industry, the military, there is a vast estate of buildings that could benefit from green rebuild technology and insurance cover. Some of the biggest gains could come from reducing CO2e through better insulation and more efficient heat, light and power consumption, with associated cost savings. Insurable risk covers are now available such as a 'Green Wrap', which incorporates general liability/workers compensation/professional indemnity for 'green' building projects.

## Behaviour

Behaviour of individuals and populations is a difficult area for private industry to have much influence over and is much more the responsibility of policymakers e.g. governments, legislators and regulators. However, the aerospace and insurance industries, working together, can create risk-based pricing signals and influence policy-makers to develop policy frameworks that can manage risk and encourage the introduction of new technologies, for example CCS, that reduce reliance on the carbon economy.

On behaviour change, the insurance industry has been actively working with public policy-makers to bring specialist risk knowledge. New frameworks of regulation and legislation are required to encourage decarbonising the existing mix of power generation. Public policy can also work together with insurance to make existing building stock more climate friendly and resilient by establishing building code changes which demand upgrades to a more efficient, green and resilient state after damage – in the same manner that is required to address necessary safety improvement with respect to electrical safety and earthquake resilience.

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## Working Together to Meet the Challenge of Climate Change

In conclusion, via a framework of technology implementation, adaptation and behaviour, there are many common actions that the insurance, aerospace and defence industries can take to reduce the impact of climate change. Further joint work on initiatives should be established in all three areas to encourage new technologies, create further adaptation to change and influence policymakers to create new legislation and regulation that will help mitigate and reduce the potential risks of climate change.